TRAIN DESCRIBERS

⟨British Practice⟩

J. E. MOTT

No. 13

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(*British Practice*)

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The Institution of Railway Signal Engineers

TRAIN DESCRIBERS

PART I

INTRODUCTION

It is a fundamental requirement of safety and efficiency that trains shall run in accordance with a predetermined plan. In practice the nominal order of train running is determined by the time-table and as this can only deal with regular services it is necessary to issue supplementary notices from day to day to indicate changes and special trains. These two sources of information form the basis of advice to the signalman of the traffic he has to control, but since the actual order of trains varies with working conditions it is necessary to advise him the definite particulars of each train as it approaches him.

With the growth of regular services of trains in England, the block system of working was introduced which incorporates a simple means of passing on the description of trains, i.e. when the sending signalman offers a train to the box ahead he gives its description by bell code and this is repeated back when accepted. In this way, a mutual understanding is established of the identity of each oncoming train.

In very busy boxes, where signalmen had to deal with trains on several tracks, it was found desirable to give some further assistance in the form of visual indication and several types of single storage describers were introduced, Tyer's and Walker's instruments being well-known examples. Whilst some of these instruments are still in use, it is not proposed to deal with them here, but to confine the scope of this treatise to the modern type of storage describer.

The introduction of the track circuit brought about substantial new developments in signalling practice, and one important feature was the introduction of automatic block sections permitting the running of several trains between boxes. It was this condition which established the need for a storage form of describer which would serve as an automatic memory for the receiving signalman. Such a device was introduced on the Metropolitan District Railway in about 1906. The unit consisted of a heavy drum with contact plungers for storage and whilst it operated well, it lacked flexibility and also had the disadvantage of requiring a multiplicity of line wires between boxes.

Development on Southern Region

It was in November, 1928, that the late Mr. W. Challis of the Southern Railway read a short paper before the Institution of Railway Signal Engineers, in which he reviewed the methods of train describing then in use, and put forward the suggestion that a new type of instrument should be devised. He quoted the features required of both transmitting and receiving instruments and invited manufacturers to put forward prototype equipment. As a result of this suggestion, a new type of train describer, based on the use of telephone equipment, was introduced, and after a trial period, it was adopted for use throughout the Coulsdon-Brighton colourlight signalling installation brought into use in 1931.

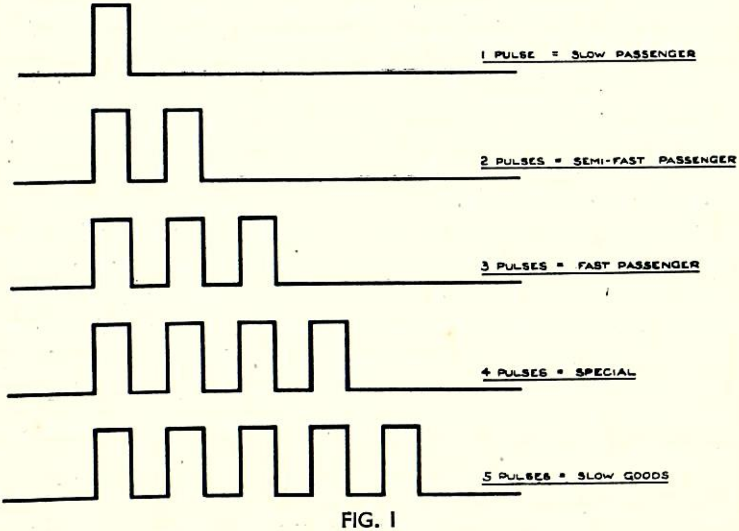


FIG. 1

Definitions

Before proceeding with a description of equipment, it is convenient to define the more general terms in use. This will avoid confusion when referring to the function of the equipment.

Code. A number of electrical impulses corresponding to a particular name, number or special signal. Fig. 1 illustrates some typical codes and relative descriptions.

Set Up. To prepare the transmitting apparatus to send a code to the receiver.

Transmit. To send a code over line wires to a receiver which may be effected with or without previous setting up.

Reset. To restore the transmitting apparatus to normal, a code having been set up but not transmitted.

Retransmit. To transmit forward to the next cabin the code of an indication displayed on a receiver.

Transfer. To transfer an indication from one instrument to another in the same cabin. This provides for train movements between tracks.

Clear. To remove an indication from a receiver, the train having left the section.

Cancel. To cancel a code in the receiver from the transmitting end, the code having been transmitted in error.

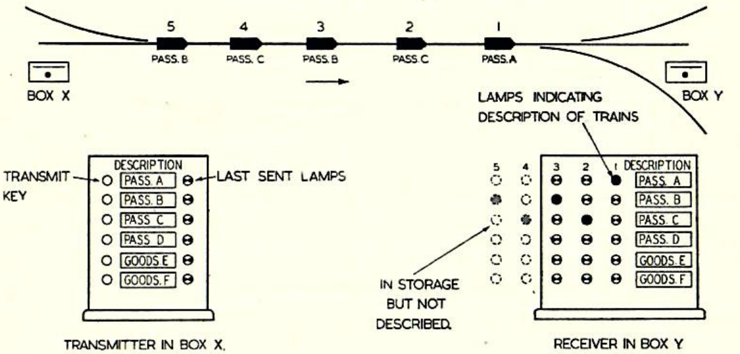
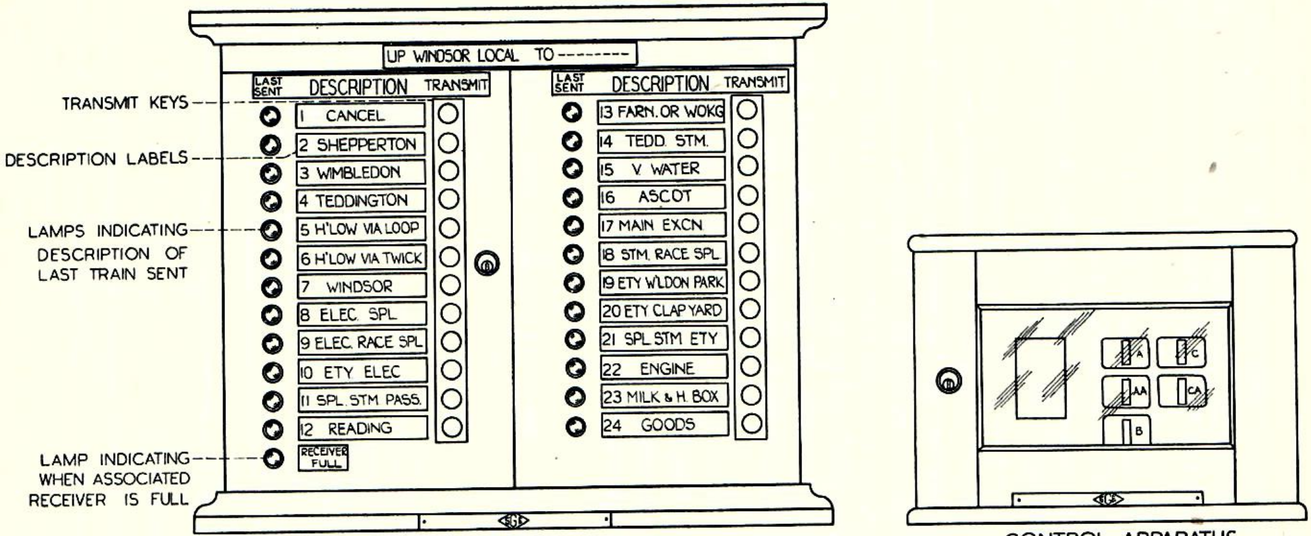


FIG. 2 BASIC REQUIREMENTS OF TRANSMITTER AND RECEIVER

Basic Requirements

Fig. 2 illustrates the application of transmitters and receivers, the basic requirements of which may be summarised as follows :—

(*a*) The transmitter shall have means of sending forward the description of each train either by push key or automatically



KEY BOX

CONTROL APPARATUS

FIG.3 TERMINAL TRANSMITTER 24 SINGLE CODES
(AS USED ON SOUTHERN REGION)

by train movement and shall retain a display of the last description sent.

(*b*) The receiver shall have storage capacity for the maximum number of trains that can be in section, the first two or three descriptions being displayed in order. When the 1st is cleared off, on arrival of the train, subsequent descriptions shall step up automatically, i.e. 2nd to 1st, 3rd to 2nd, and so on.

(*c*) It shall be possible for descriptions to be transferred from one instrument to another to correspond with train movements from fast to slow line, etc.

(*d*) These facilities shall be provided economically and in particular only a minimum number of line wires shall be required between each transmitter and receiver.

PART II

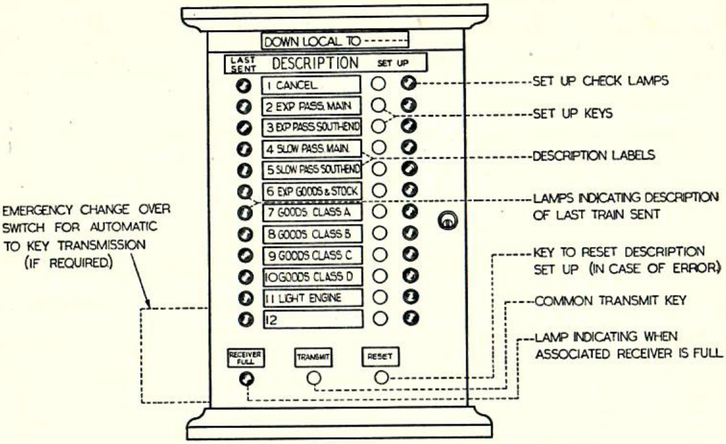
Typical Operating Instruments

Consideration will now be given to typical instruments of simplified construction, and it is to be noted that the general practice is to separate operating and indicating instruments from the control apparatus. This keeps the overall dimensions of the instruments to a minimum, as well as permitting the control apparatus to be housed where it is readily accessible.

Terminal Transmitters

(*a*) *General.* Fig. 3 illustrates a simple form of transmitter as used on the Southern Region. The keybox shelf instrument and control apparatus cabinet are shown side by side to illustrate comparative sizes. A transmit key, label and " last sent " lamp are provided for each description, and transmission to the cabin ahead is effected by the signalman depressing the transmit key alongside the appropriate label. This causes a code of electrical impulses to be sent forward over the line wires. Two sizes of these instruments are in use, 12 single codes, and 24 single codes as illustrated.

Fig. 4 shows another type of transmitter which provides for the description to be " set up " on the instrument as soon as the identity of the approaching train is known, actual transmission



KEY BOX

FIG.4 TERMINAL TRANSMITTER 12 SINGLE CODES (WITH SET UP KEYS)

being effected later, i.e. when the train passes the box or a particular location.

A " set up " key and check lamp, label and " last sent " lamp are provided for each description and a common reset key is included to restore the equipment to normal should an incorrect " set up " be made. Transmission of a set up is effected automatically by track circuit and/or signal operation, or by the signalman depressing a common transmit key. If transmission is effected automatically a transmit key is still required for use in case of track circuit failure, etc., and also for testing, but it may be rendered normally inoperative and only put into use after a separate emergency changeover switch has been operated.

(*b*) *Last Sent Lamp.* The last sent column is provided to remind the signalman of the last description he has sent forward, the indication usually being displayed until another train is described. This makes for simplicity, but there are some instruments in use where this display is removed automatically from the transmitter as soon as the train enters the section ahead.

(*c*) *Not Described Check.* Should a train proceed into the section ahead without having been described and a second train be described in the normal manner, the receiving signalman will think that the description for the second train belongs to the first. In order to avoid such a misunderstanding, an automatic check can be made to ensure that a description is sent forward for each train. A simple method is to arrange for an alarm lamp to glow on the transmitter in association with an audible alarm to call the signalman's attention to the omission. Alternatively, a description labelled "not described" may be sent forward automatically.

The track or signal condition used for this check must be carefully selected to avoid shunting moves being recorded as through trains. For this reason it is often necessary to use a condition further into the section than that associated with normal transmission. Fig. 5 illustrates a typical arrangement; transmission being effected by lever 1 reversed, and the "not described" check with lever 2 reversed and track A down.

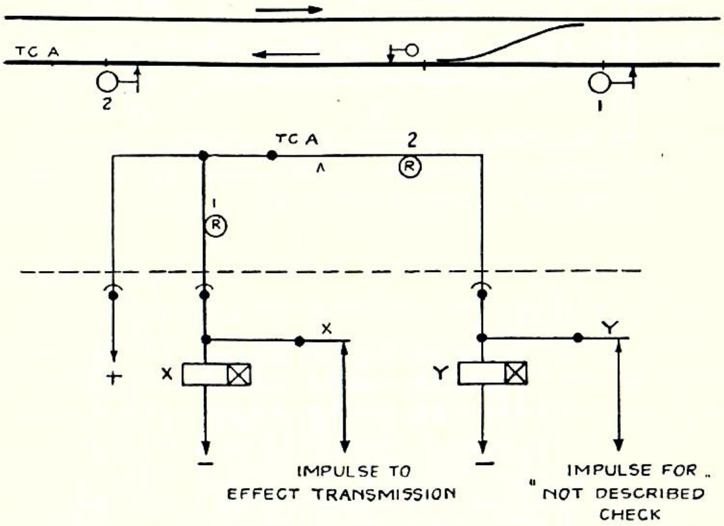
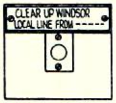


FIG. 5 Typical Circuit for Automatic Transmission and "Not Described" Check.

(*d*) *Cancelling.* Circumstances may arise in service where it is desired to alter a description which has been sent forward due to a traffic change, or to an error when describing. It is then necessary to take steps to avoid a misunderstanding with the receiving signalman. If the faulty description is the last sent forward, provision can be made to effect cancellation, but if it has been followed by other descriptions for subsequent trains, the best procedure is to advise the receiving signalman by



CLEARANCE KEY

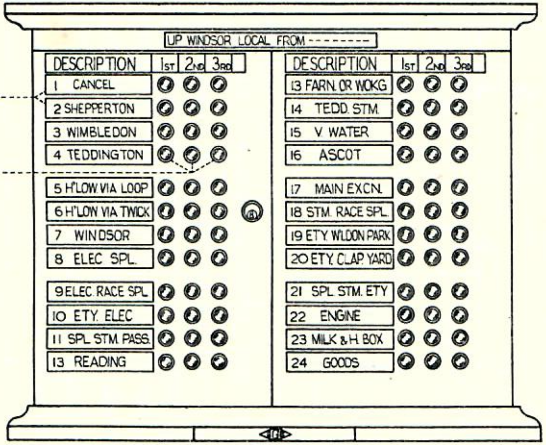
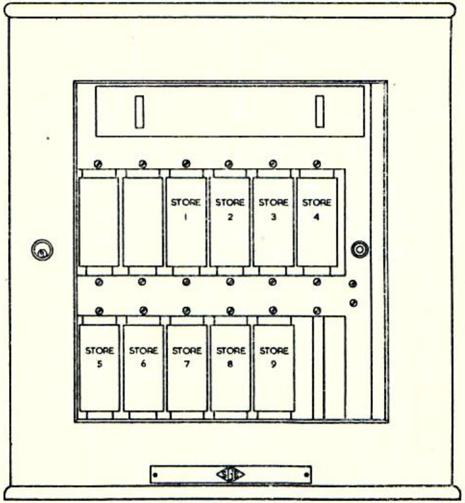


FIG.6. TERMINAL RECEIVER INDICATOR 24 SINGLE CODES
(AS USED ON SOUTHERN REGION)



CONTROL APPARATUS

telephone of the error. Typical methods of cancelling the " last description sent forward " are as follows :—

(i) Send a normal description labelled " cancel " which at the receiving end is understood to mean that the description ahead of it is in error.

(ii) Employ a co-operative method, whereby cancellation is initiated by the sending of an ordinary description labelled " cancel," but at the receiving end cancellation is not effected until the signalman depresses an acknowledgment key on his instrument.

(iii) An immediate co-operative method whereby both sending and receiving signalmen must depress cancel keys simultaneously.

It will be appreciated that instruments with " set up " lamps provide the signalman with a check before transmission and that he can restore a " set up " by depressing his reset key.

Terminal Receivers

Fig. 6 illustrates the form of receiver as used on the Southern Region and which operates in conjunction with the transmitter illustrated in fig. 3. The indicator shelf instrument and control apparatus cabinet are shown side by side, the latter being equipped with storage for 9 trains. Three lamps are mounted alongside each description label to indicate the 1st, 2nd and 3rd trains in storage. Subsequent descriptions which are stored in the apparatus step up into the display columns in cyclic order as clearances are made. A separate key box is provided to clear descriptions.

Simple Method of Operation using Terminal Instruments

The simplest method of working is to employ a terminal transmitter at each sending box and an associated terminal receiver at the next box.

With this arrangement, a description transmitted from the terminus is displayed at the next box until the train arrives when it is cleared off, meanwhile the signalman sends the same description forward on a separate transmitter to the next box. This process of receiving and transmitting afresh continues as the train proceeds on its journey. Fig. 7 is a layout of an installation

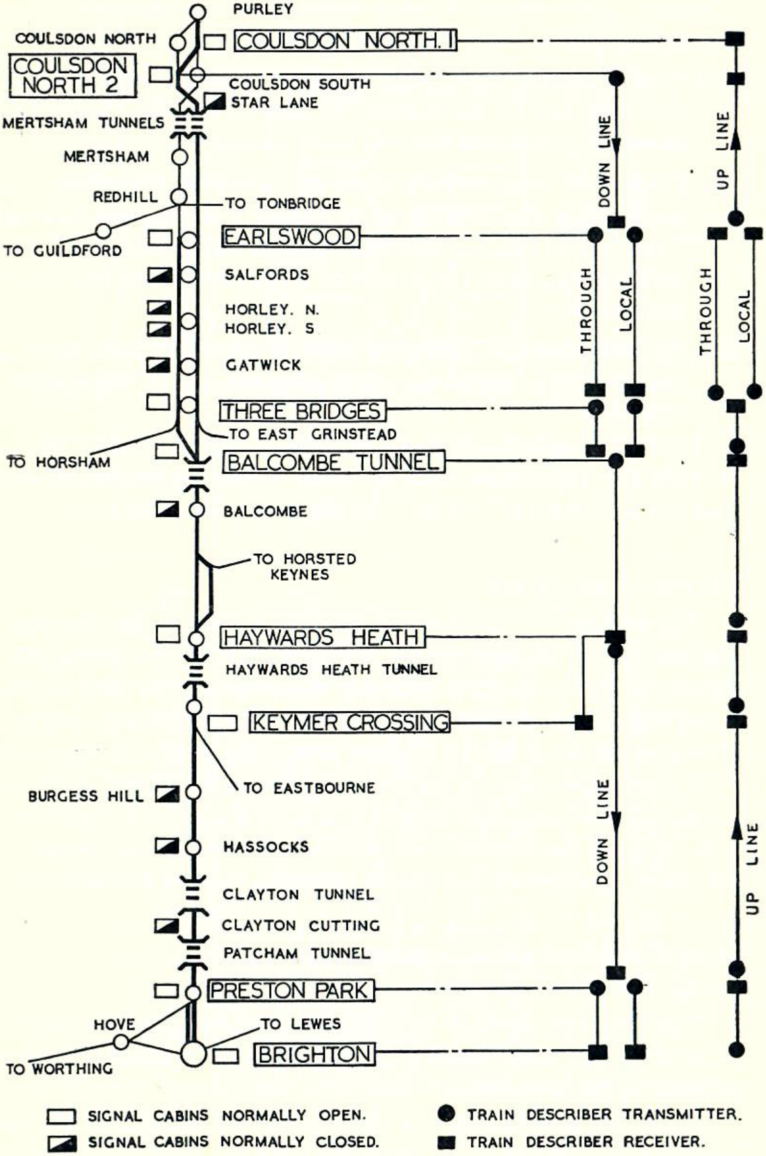


FIG. 7 SCHEME OF OPERATION USING TERMINAL INSTRUMENTS

employing this method on the Southern Region between Coulsdon and Brighton and it is interesting to note that this includes an example of two receivers operating from one transmitter.

Comprehensive Method of Operation using Retransmitters

An economy of effort can be brought about at intermediate boxes if combined transmitters and receivers be used, since all trains passing through will only require the description to be sent on as received. This can be effected with a common restransmit key or automatically from the transmitting part of the instrument. It will only be necessary to provide description keys for originating trains which can start at that point.

Retransmitters

Fig. 8 illustrates a typical retransmitter instrument which consists of a Transmitter Keybox as fig. 4, and a receiver indicator as fig. 6 but for 12 codes. The " retransmit key " will send forward the 1st description displayed and clear it from the instrument, whilst the " clear key " will clear a description without retransmitting to provide for a train terminating. The " transmit key " interposes descriptions " set up " for trains originating at the box.

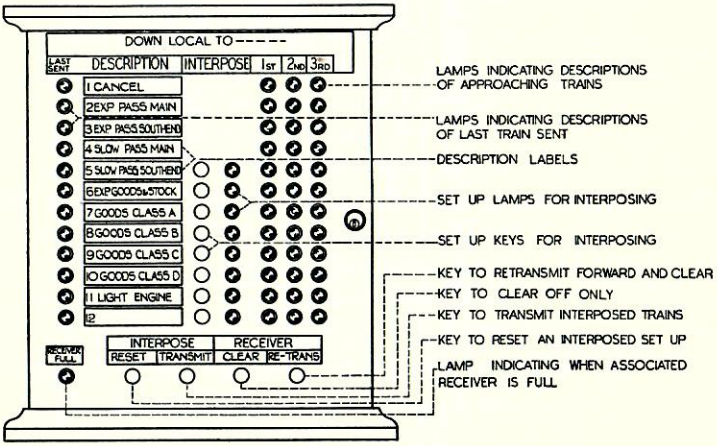


FIG. 8 RETRANSMITTER KEY BOX AND INDICATOR 12 SINGLE CODES

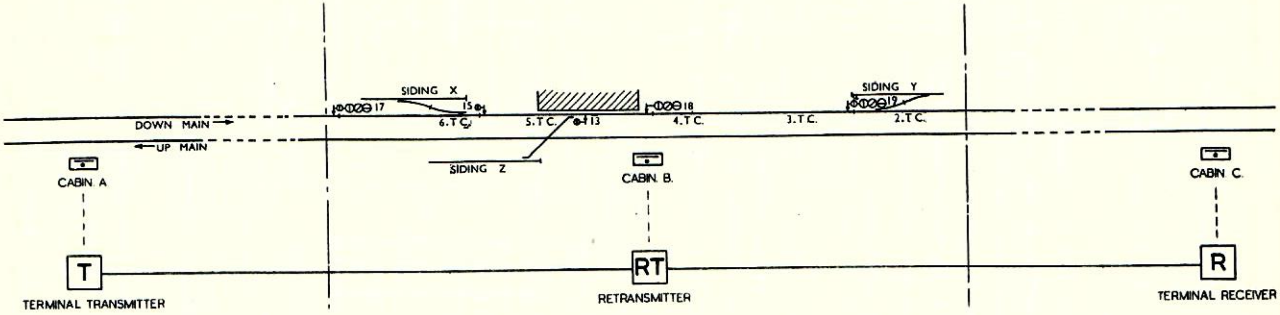


FIG 9 APPLICATION OF RETRANSMITTER
WITH AUTOMATIC WORKING

Example of Automatic Working

Fig. 9 is a typical layout of an intermediate station with sidings employing a retransmitter instrument as fig. 8, and consideration will now be given to the conditions required to make operations automatically, e.g. retransmission for trains passing through, clearance for trains terminating and transmission for trains being interposed from the sidings.

When a train enters the section from cabin "A," the first condition registered is at a point over which shunting does not take place, i.e. lever 17 rev. and track circuit 6 occupied. Progress is then recorded as the train proceeds, until the route has been determined.

(*a*) *Clearance by train from Cabin "A" terminating at Siding "X"*

(i) Lever 17 rev. and track 6 occupied.
(ii) Track 5 occupied and lever 15 rev.

N.B.—If it is considered desirable to retain the description until the train has left the main line, then the condition of track 5 clear may be added.

(*b*) *Clearance by train from Cabin "A" terminating at Siding "Z"*

(i) Lever 17 rev. and track 6 occupied.
(ii) Track 5 occupied and lever 13 rev.

(*c*) *Clearance by train from Cabin "A" terminating at Siding "Y"*

(i) Lever 17 rev. and track 6 occupied.
(ii) Track 5 occupied and lever 18 rev.
(iii) Track 3 occupied and lever 14 rev.

(*d*) *Retransmission of train from Cabin "A" proceeding to Box "C"*

(i) Lever 17 rev. and track 6 occupied.
(ii) Track 5 occupied and lever 18 rev.
(iii) Track 3 occupied and lever 19 rev.

(*e*) *Transmission of interposed descriptions for train from Sidings "X," "Y," "Z" and " Not described " Check*

(i) Track 3 occupied and lever 19 rev.

Movement from Track to Track

When instruments are required to work automatically, they may have to provide for train movements from one track to another. Fig. 10 (shown on pages 18 and 19) illustrates typical retransmitting instruments arranged to meet this requirement. Separate retransmitters are provided for the down main and down electric lines and, in order to provide for movements from one track to the other, separate " arrived " display levels are added which indicate the actual presence of a train on tracks approaching a particular signal.

Considering the down main instrument ; the first and second trains from the preceding cabin are displayed on the " in section " levels until signal 16 is passed, when a train may make one of the following movements :—

(*a*) Continue along the down main to signals 17 and 18 and into the next section, in which case its description automatically steps from the 1st " in section " to the level "arrived 17," to " arrived 18," and then to the " last sent " position when it has been retransmitted forward.

(*b*) Alternatively, switch over to the electric line to signals 11, 12 and on to the next cabin. In this case its description is transferred from 1st " in section " on the main instrument to " arrived signal 11 " on the down electric instrument, and thence to the " arrived signal 12 " and into the " last sent " position.

(*c*) Alternatively, switch to the electric line signal 11 and then switch back to the main line. In this case the description is transferred from the 1st " in section " level on the main instrument to " arrived signal 11 " on the electric line instrument and thence back to " arrived signal 18 " on the down main and to the " last sent " position when it has been retransmitted forward.

Similarly, a train at signal 10 on the down electric may continue on the same line, or switch over to the down main at signal 11. If this latter movement takes place, the description transfers from the 1st " in section " on the down electric instrument to " arrived signal 11 " and then across to the main instrument to follow the train movement.

At complicated interlockings it may also be desirable to provide " arrived " levels on transmitting instruments for trains which are in the control area of the main box. Descriptions set up are then automatically stepped to successive " arrived " levels, transmission being made as soon as the route is set.

Fig. 11 illustrates transmitting and receiving instruments at a large terminal station providing automatic operation with " arrived " levels for receivers and transmitters. This particular installation extends from Liverpool Street to Romford, and

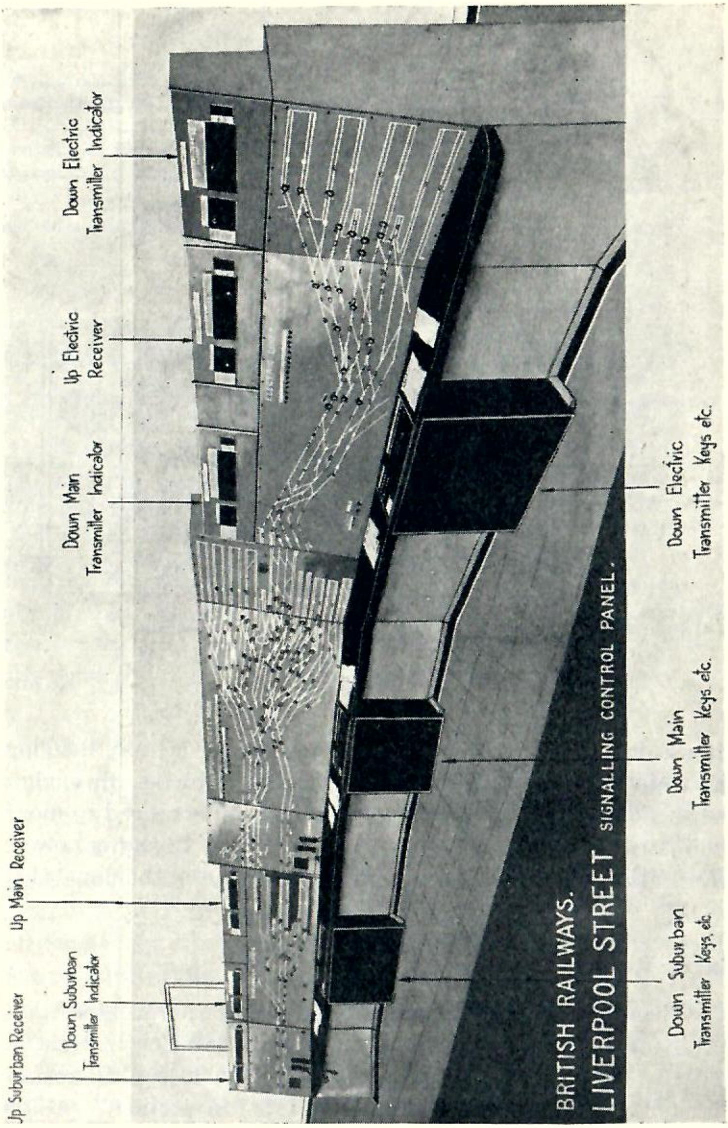

Jp Suburban Receiver
Down Suburban Transmitter Indicator
Up Main Receiver
Down Main Transmitter Indicator
Up Electric Receiver
Down Electric Transmitter Indicator
Down Suburban Transmitter Keys etc.
Down Main Transmitter Keys etc.
Down Electric Transmitter Keys etc.
BRITISH RAILWAYS.
LIVERPOOL STREET SIGNALLING CONTROL PANEL.

FIG. 11

TRANSMITTING AND RECEIVING INSTRUMENTS MOUNTED IN RELAY INTERLOCKING PANEL, LIVERPOOL STREET, E.R.

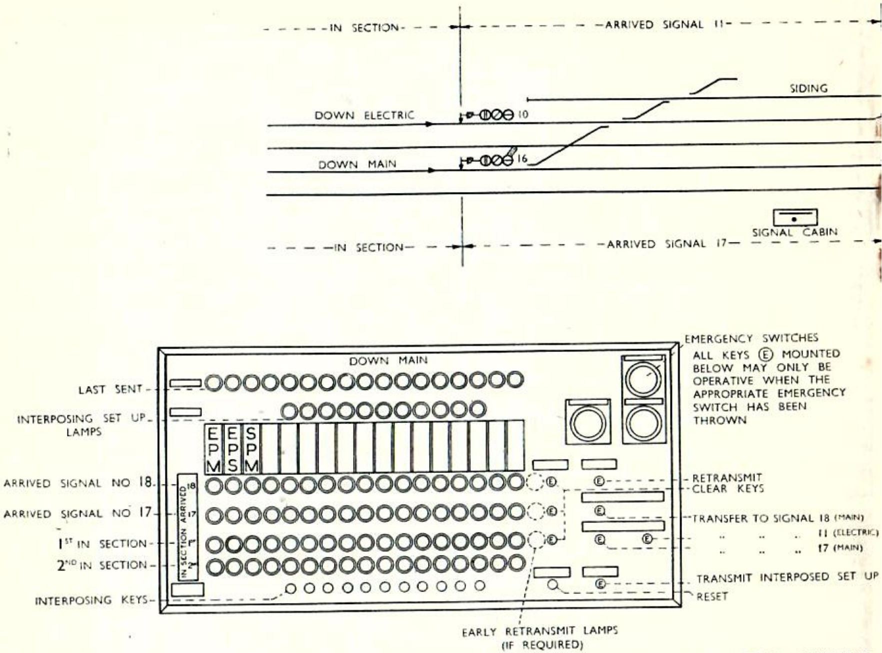


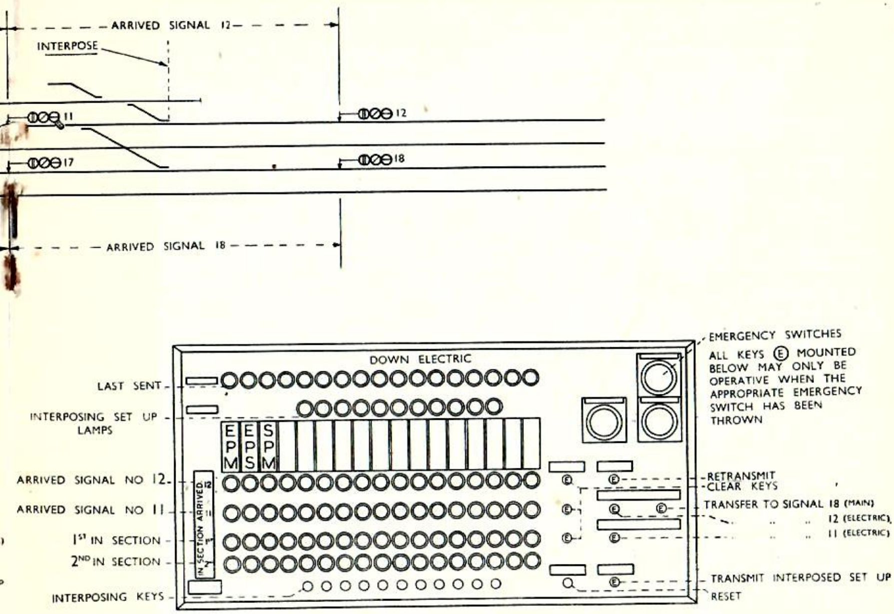
FIG.10. RETRANSMITTERS

ILLUSTRATING TYPICAL OPE

after a dual description has been originated for a train, it follows the train movement automatically from box to box throughout the section. The relay interlocking panels are arranged to mount the instruments in a convenient manner. Fig. 12 shows how the transmitter keyboards have been incorporated in the panel shelf.

Early Retransmission

When it is desired to give early advice of approaching trains, retransmission to the next box may be made before a train has actually arrived, i.e. in the example shown in fig. 10 retransmission could be effected from the 1st "in section" position immediately the route through the junctions and into the block section is set up. A lamp labelled "retransmitted" is then added at the end of the 1st "in section" and at each "arrived" level, and when a description has been retransmitted early this lamp is illuminated alongside.



AND TRACK LAYOUT

RATION FROM TRACK TO TRACK

Light Engines

In addition to the describing of normal trains, facilities are sometimes required to cover the working of light engines from locomotive sheds, and these may arrive singly or with several coupled together, in which case the individual destinations will be required. It may be found necessary to provide special instruments for this purpose either working separately or in association with the normal describers.

A good example is the arrangement employed between Loco. Junction and Waterloo signal boxes. A separate transmitter and receiver groups are provided to deal with up to five coupled engines. Fig. 13 illustrates the principle of the arrangement and fig. 14 the receivers in Waterloo box. The three ordinary receivers grouped on the left serve the up through line diverging to the up relief or up through at Vauxhall and the two engine receivers on the right provide for first and second groups of engines.

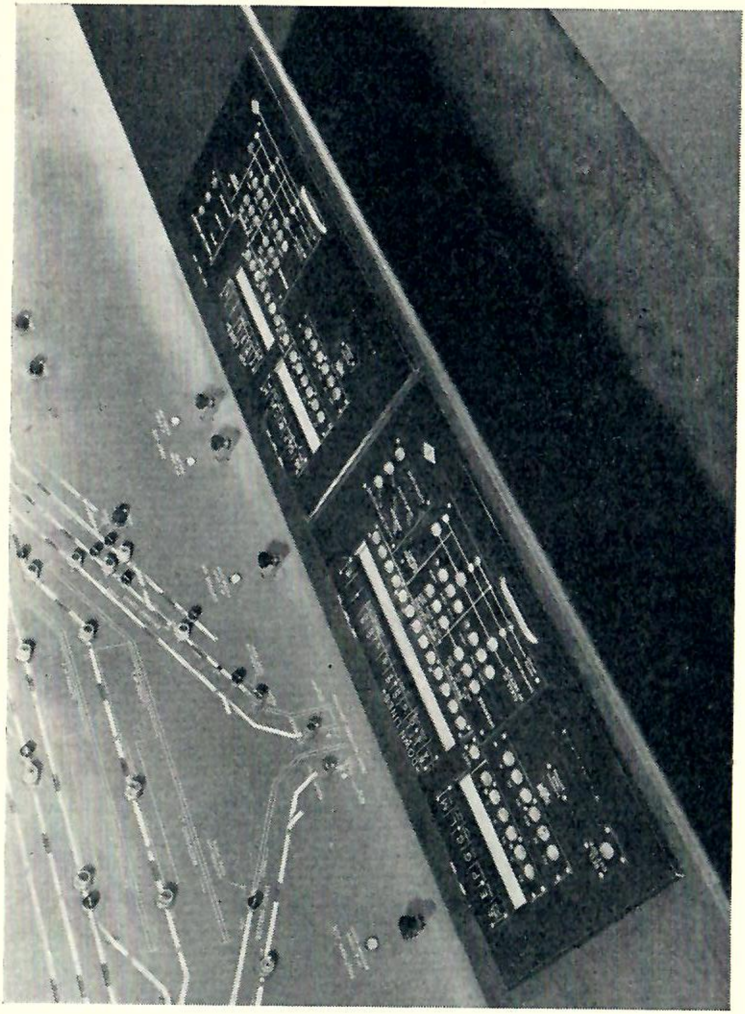
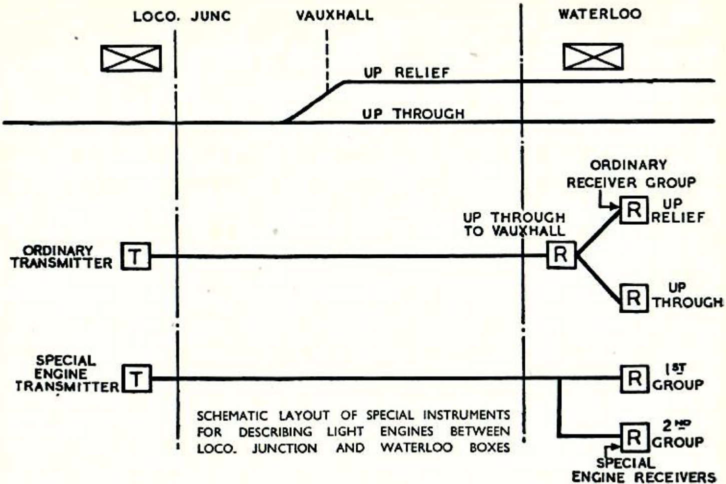


FIG. 12
TRANSMITTER KEYBOARDS
INCORPORATED IN RELAY INTERLOCKING PANEL SHELF

The procedure requires the signalman in Loco. Junction box to transmit " light engine " on his ordinary describer and then to transmit the separate destinations of the coupled engines on the engine transmitter. At Waterloo the description " light engine " appears on the ordinary receiver, and the destinations of the coupled engines are displayed in order on the separate



SCHEMATIC LAYOUT OF SPECIAL INSTRUMENTS FOR DESCRIBING LIGHT ENGINES BETWEEN LOCO. JUNCTION AND WATERLOO BOXES

FIG. 13

engine receiver. The signalman clears off the engines one by one as they are routed to their respective platforms. A feature of this arrangement is that the engine instruments employ circuits very similar to those used on ordinary instruments.

Number of Code Parts

Trains may be described by means of a single or a multiple part code, but the cost of the equipment increases with the number of code parts. It is preferable, therefore, to use a single part code if at all possible, and to regard a two-part code as the desirable maximum.

Single Part Code. The illustrations which have been used so far employ a single part code, i.e. combined destination or route with the type of train. Examples are :—

Express Passenger Southend
Express Passenger Main
Slow Passenger Main

Two-Part Code. The use of a two-part code permits one part to be used for the destination and the other part for the description, and as each may be used in combination a larger number of complete train descriptions is available than the number of keys, i.e. if 6 destination and 6 description keys be

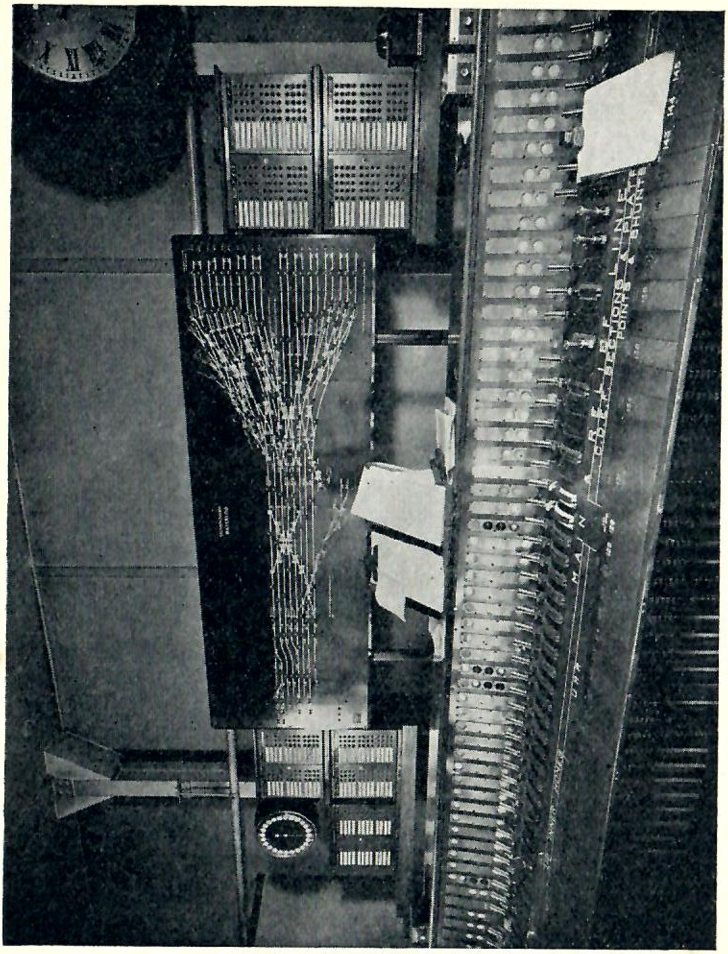


FIG. 14
SPECIAL LIGHT ENGINE AND ORDINARY RECEIVER INSTRUMENTS IN WATERLOO BOX

provided, a total of 12 keys, then 36 different descriptions are available. Examples are :—

Destination	*Description*
Glasgow	Express Passenger
Edinburgh	Slow Passenger
Main Line	Fast Goods
Slow Line	Slow Goods

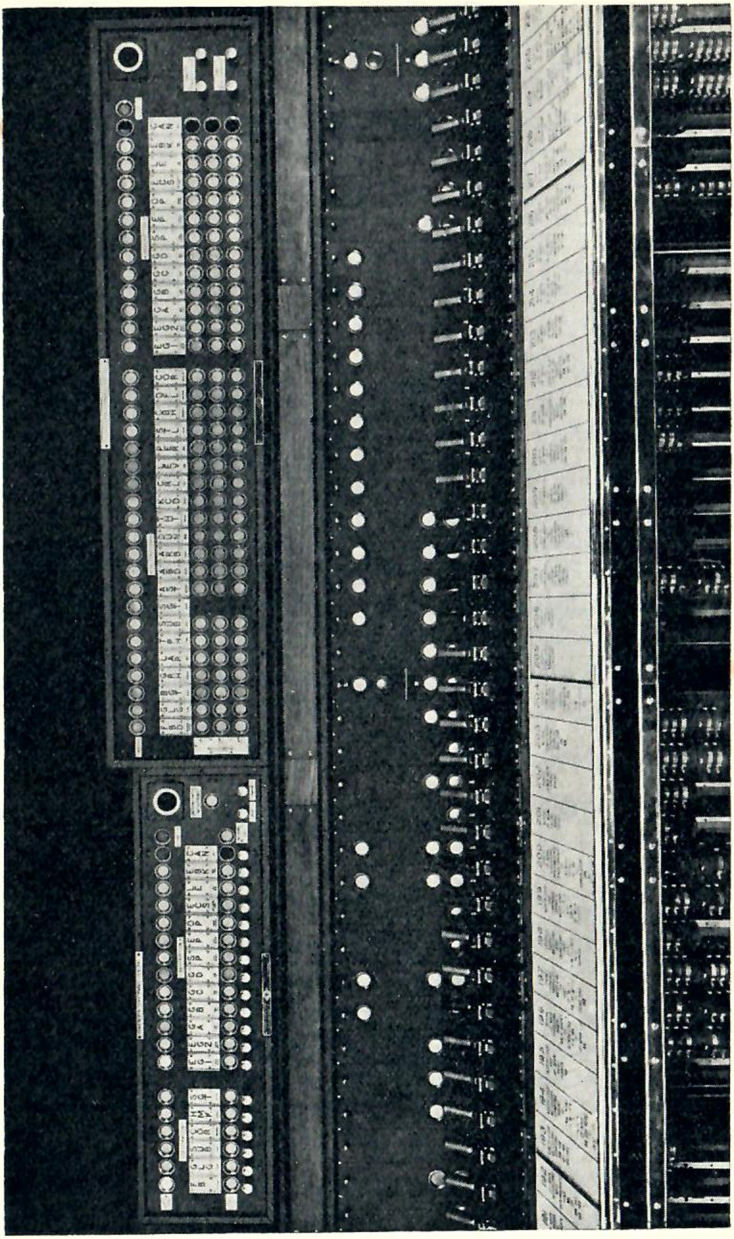


FIG. 15
TYPICAL TWO-PART CODE RECEIVER AND TRANSMITTER INSTRUMENTS
(WAVERLEY, EDINBURGH)

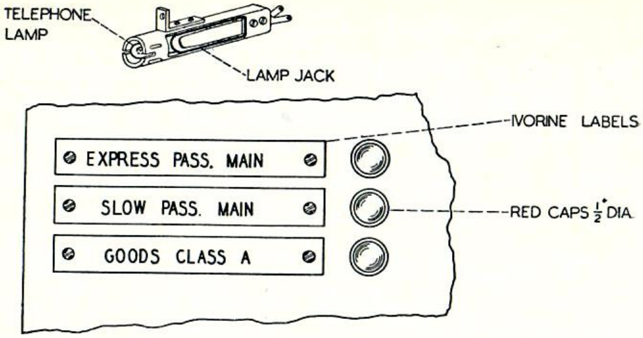


FIG.A ENGRAVED LABEL WITH SINGLE TELEPHONE LAMP INDICATION

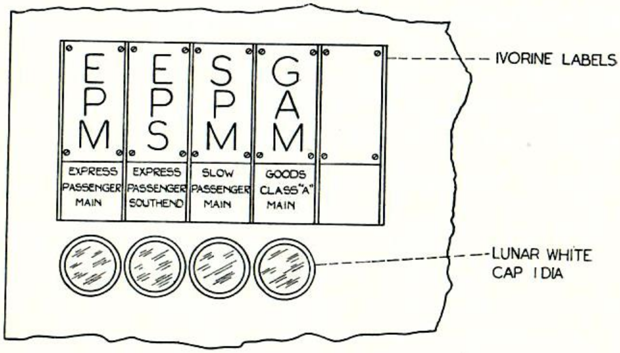


FIG. B ENGRAVED LABEL WITH SINGLE 12 VOLT – 4 WATT LAMP OR DUPLICATED TELEPHONE LAMPS

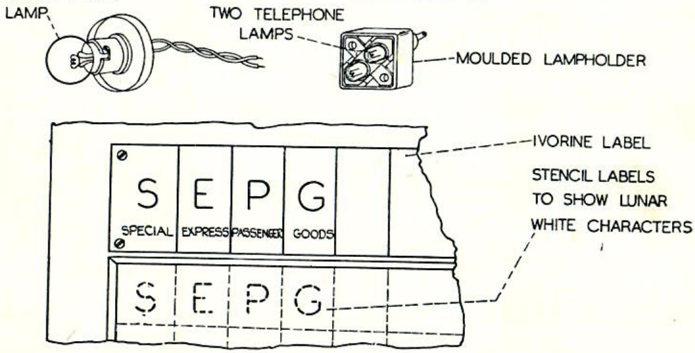


FIG.C STENCIL INDICATIONS ILLUMINATED BY 12 VOLT-4 WATT LAMP OR DUPLICATED TELEPHONE LAMPS

FIG. 16 TYPICAL FORMS OF INDICATION

Fig. 15 illustrates typical instruments.

Three-Part Code. A three or larger multiple part code may be used for the numerical describing of trains or where more destinations or descriptions are required than can be met by a two-part system.

Indicator Form

The indication used on transmitter and receiver indicators usually employ the telephone type lamp or small B.C. 12 v. 4 w. lamp. Large overhead indicators may use standard B.C. lamps.

The single telephone indication is most effective when fitted with a large size red cap approx. ½-in. diameter, as illustrated in fig. 16A.

Figs. 16B and 16C are typical larger size indications using the 12 v. 4 w. lamp or duplicated telephone lamps. The amount of light available is sufficient to give a lunar white indication through a cover glass of pot-blue flashed opal. Duplicated telephone lamps will reduce the risk of losing an indication due to lamp failure, in particular if one of the lamps be underrun by connecting a resistance in series.

Fig. 16C shows the use of a stencil to enable the signalman to recognise descriptions more readily.

PART III

Design of Equipment—General

It is now convenient to give more detailed consideration to the design of control equipment, the basic essentials of which are :—

(i) That it shall be possible to send descriptions from transmitters to receivers with the use of as few line wires as possible.

(ii) To provide adequate storage with flexibility of control for movements from track to track.

Line Transmission

Practical means of sending descriptions over a minimum number of wires are :—

(*a*) *Selection of different line wire pairs or combinations of lines—using unidirectional current, i.e. " AB," " AC," " AD," etc.* With six line wires, 15 different line pairs may be reliably selected. If three or more combinations of lines be made such as "ABC," "ABD," etc., more selections can be made, but this arrangement would be unsatisfactory because a disconnection in one circuit would give an incorrect indication.

(*b*) *Selection of different line wire pairs or combinations of lines—using polarised current.*

If the line selection be arranged to respond to the direction of current flow by using rectifiers or polarised relays then twice the number of selections can be obtained.

(*c*) *Step-by-Step Impulsing*

This method requires only two line wires, each description being characterised by a different code of impulses. It is the basic principle employed in automatic telephony and is generally used in the modern train describer. A series of impulses covering the description of a train may be made up of d.c. pulses at regular intervals, and one or more pauses or polarised impulses may be used as a further means of differentiation.

Line Impulse Check

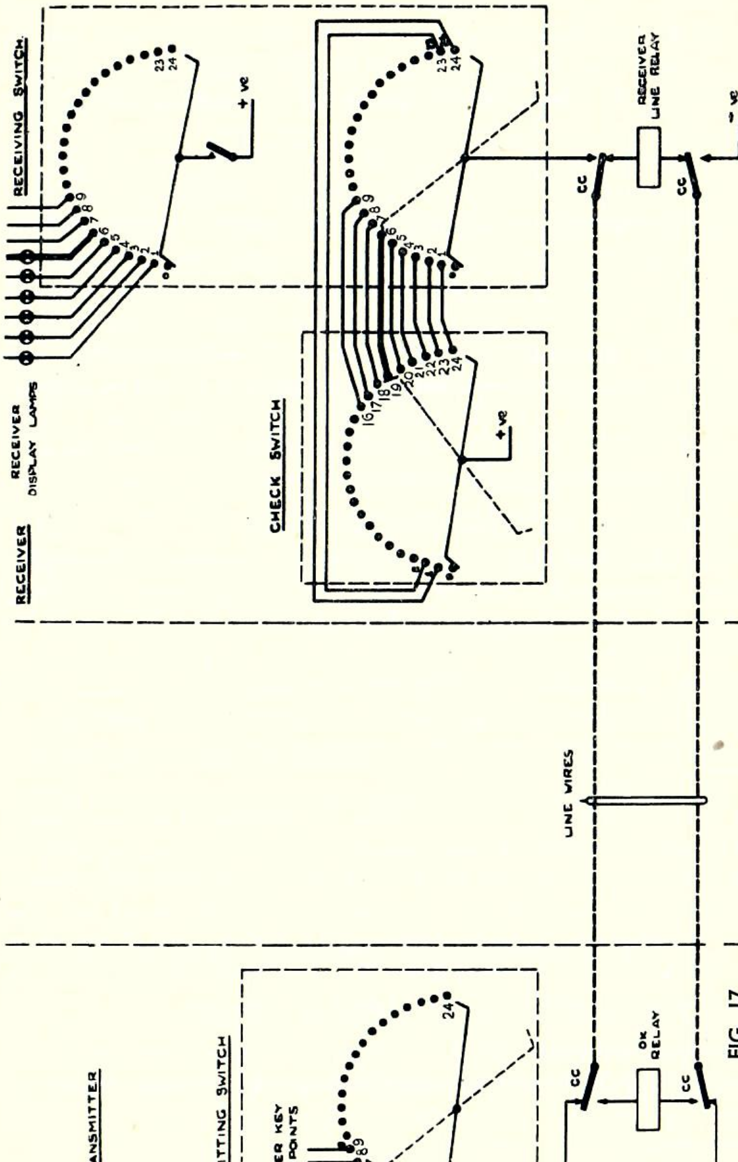
There are several methods of sending descriptions as codes of electrical impulses, the simplest being open line impulsing without special checking means, i.e. the line loop to the distant receiver relay is made and broken at the transmitter and the relay at the receiver is presumed to respond correctly to these interruptions. A large number of instruments are in use employing this method, the equipment being designed with a high margin of safety to ensure reliable operation.

A means of checking receiver impulses may be employed, but in all cases extra apparatus is required. Typical methods of checking are :—

(i) *Individual Impulse Check.* Whereby each impulse applied to the line circuit at the transmitter is held until released by the receiver.

(ii) *Complete Check Back by Repetition.* The code received by open line impulses is completely sent back to the transmitter and checked to correspond with the original set up.

(iii) *Total Code Check.* The favoured method where checking is employed, a constant number of impulses being sent for each code and a pause or reversal being introduced to characterise each particular code.



ELEMENTS OF TOTAL CODE CHECK CIRCUIT

FIG. 17

Fig. 17 shows the circuit elements of a typical arrangement in which a pause is introduced to differentiate each specific code from others, e.g. one impulse pause 24 impulses is code 1 ; two impulses pause 23 impulses is code 2, and so on.

The transmitter key marks the " pause point " on the transmitting switch, whilst at the receiver the impulses recorded before the pause step the receiving switch, and the impulses received after the pause step the check switch. When a complete code of impulses has been sent, contacts " CC " operate at both ends, and if the impulses received total the correct number, the multiple connecting the receiving and check switches complete a circuit to operate relay " OK " at the transmitter. The " last sent " lamp is then illuminated and at the receiver, the description is displayed via receiving switch level 2.

Number of Line Wires Between Boxes

Mention has already been made that to operate between a single transmitter and receiver with step-by-step impulsing only two line wires are required. If there are instruments for several tracks further line economy may be possible, but it is unwise to use switching arrangements which will permit a fault on one instrument to affect other instruments. It is a fundamental requirement, therefore, that no common apparatus shall be used at either end for this purpose.

Where there are a multiplicity of instruments between boxes it is often desirable to use two wires between each transmitter and receiver, as shown in fig. 18A, but with some instruments satisfactory operation may be obtained with the use of one wire per track, plus a common return, i.e. for up and down lines, 3 wires, and for up and down fast and slow lines, 5 wires, as shown in fig. 18B. Fig. 18C should not be used.

Receiver Storage

Storage and control means which have been employed are :—

(i) Mechanical
(ii) Paper Tape
(iii) Telephone Apparatus

(i) *Mechanical.* The earliest form of describer employed a heavy rotating drum for storage and transmission was effected

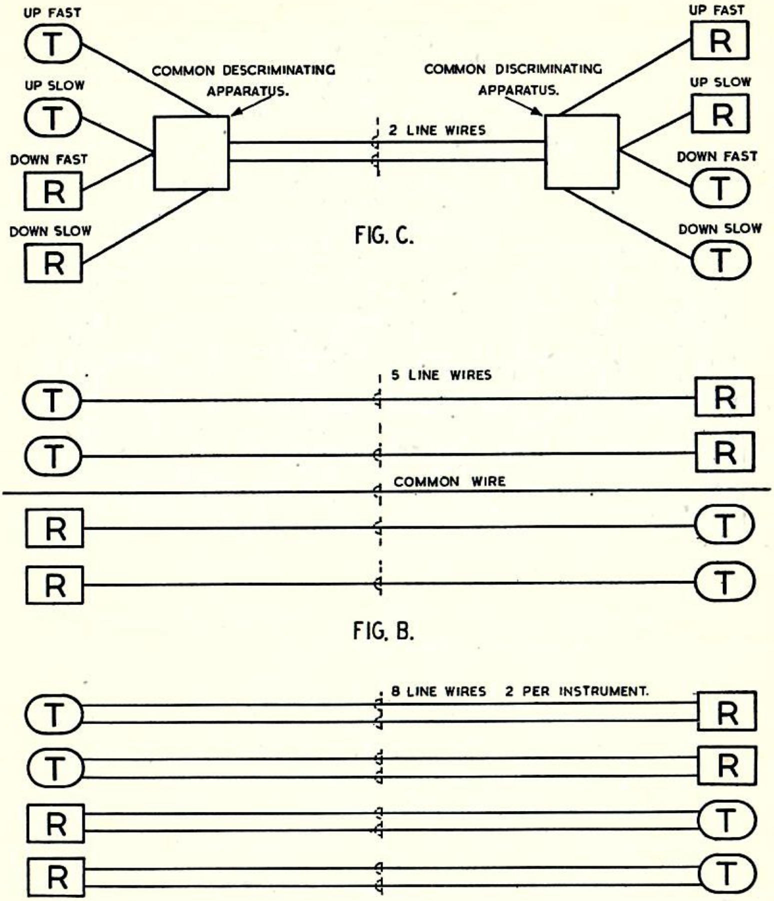


FIG. C.

FIG. B.

FIG. A.

FIG. 18 ALTERNATIVE LINE CONNECTIONS BETWEEN BOXES.

over a multiplicity of line wires, a different combination being selected for each particular code. This design proved satisfactory to a limited degree, but was not flexible.

(ii) *Paper Tape*. Describing equipment using paper tape storage is in use where large storage capacities are required and little flexibility. Fig. 19 illustrates a typical receiver unit. Step-by-step impulsing is employed and perforations are made in the tape to record the particular description code received. When the description is required to be displayed

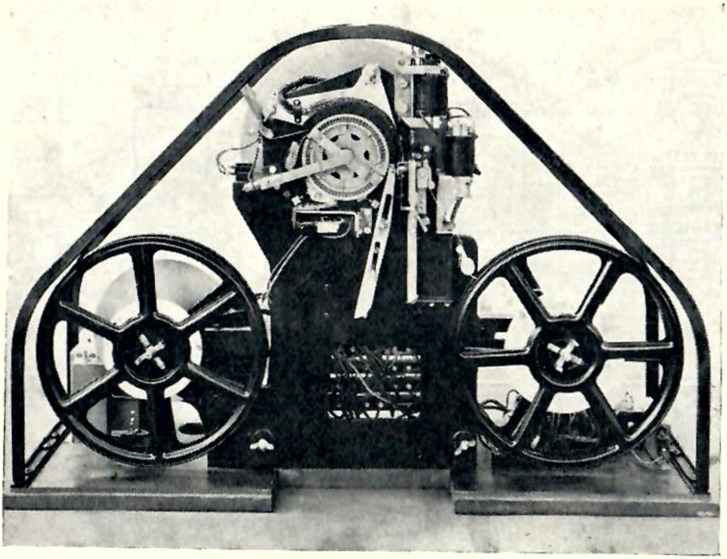


FIG. 19

RECEIVER CONTROL EQUIPMENT EMPLOYING PAPER TAPE FOR STORAGE (L.T.E.)

the tape is passed through a sensing plate which operates the appropriate display relays. Advantages of tape storage are that only an additional length of tape is required for each storage, and also the tape serves as a permanent record. The system is limited in application, however, because it is not readily flexible and hence is not suitable for layouts with crossovers, sidings, etc.

(iii) *Telephone Apparatus.* The sending, receiving, storing and switching of train descriptions is analogous to the requirements of automatic telephony and also to remote control systems for which telephone apparatus has been extensively employed. It follows, therefore, that by using this apparatus the signal engineer benefits from the experience of these applications. When designing circuits for train describers special attention is given to avoiding marginal relay timings and special adjustments, since reliability is of the utmost importance. Fig. 20 illustrates a typical cabinet which may contain control apparatus for more than one shelf instrument ; an arrangement often adopted where several instruments

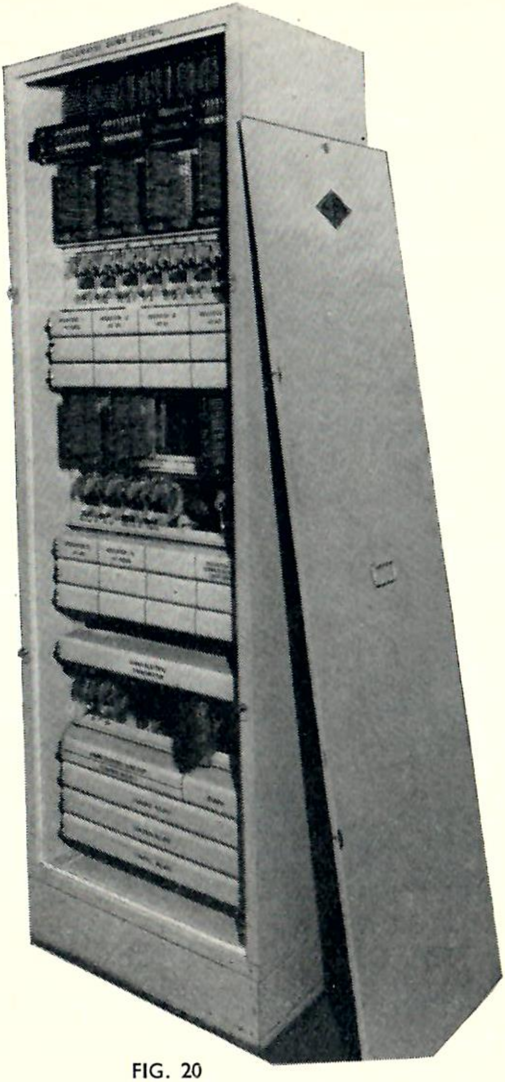


FIG. 20

TYPICAL CONTROL APPARATUS CABINET

are in the same box and where automatic operations by train movement are required.

The P.O. 3000 Type Relay

Various proprietary designs of telephone relays are available, but it is generally considered desirable to use the standard P.O.

3000 type relay. Its most important features are :—

- (i) High magnetic efficiency.
- (ii) Duplicate contacts.
- (iii) Use of silver or platinum for contacting.
- (iv) Use of buffer block to ensure adequate spring contact pressure and clearance, and to simplify adjustment.

Fig. 21 illustrates this relay ; fig. A constructed for a normal quick operate and release characteristic ; fig. B with a copper slug remote from the armature to give a slow to release characteristic ; and fig. C with a copper slug adjacent to the armature to give a slow to operate and release characteristic.

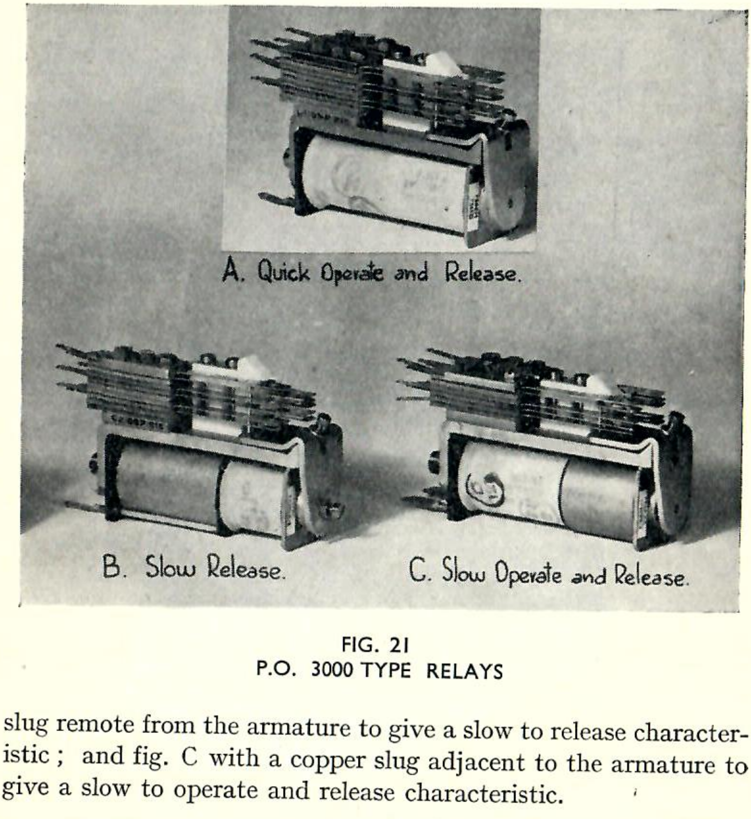


FIG. 21
P.O. 3000 TYPE RELAYS

Uniselector Switch, etc.

As a means of selecting, sequencing and storing, a G.P.O. 25-point Uniselector Switch is often employed, an example of which is illustrated in fig. 22. This switch consists of several banks of insulated contacts each traversed by a separate connecting wiper, the whole wiper assembly being driven by an

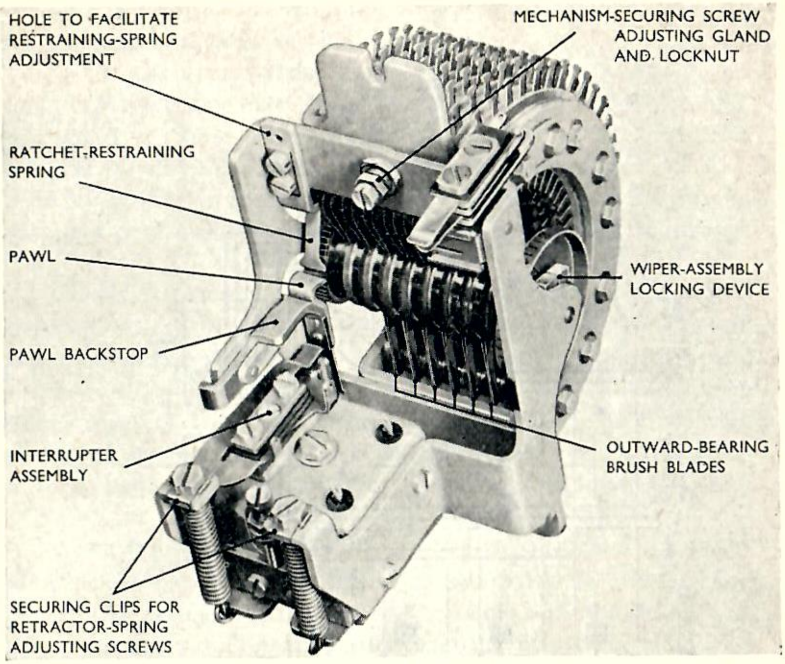

HOLE TO FACILITATE RESTRAINING-SPRING ADJUSTMENT
MECHANISM-SECURING SCREW
ADJUSTING GLAND AND LOCKNUT
RATCHET-RESTRAINING SPRING
PAWL
WIPER-ASSEMBLY LOCKING DEVICE
PAWL BACKSTOP
INTERRUPTER ASSEMBLY
OUTWARD-BEARING BRUSH BLADES
SECURING CLIPS FOR RETRACTOR-SPRING ADJUSTING SCREWS

FIG. 22
TYPICAL G.P.O. 25-POINT UNISELECTOR SWITCH

electro-magnet through a spring loaded ratchet mechanism. The contact wipers step once for each impulse. The switches have 25 contacts and are available in sizes up to 8 levels.

As an alternative to this G.P.O. switch, a proprietary form of motor driven sequence switch has sometimes been used.

Typical Transmitter and Receiver Circuits

Fig. 23 illustrates the basic principles of a transmitter and receiver employing open line impulsing. Two levels of a uniselector switch are shown at the transmitter, one to effect the " last sent " display and the other for marking, i.e. to determine the number of impulses which shall be sent out to line for each particular code.

When transmission is initiated the switch commences to step, one contact being passed over for each impulse sent out to line by relay " A." Stepping continues until the marked point is

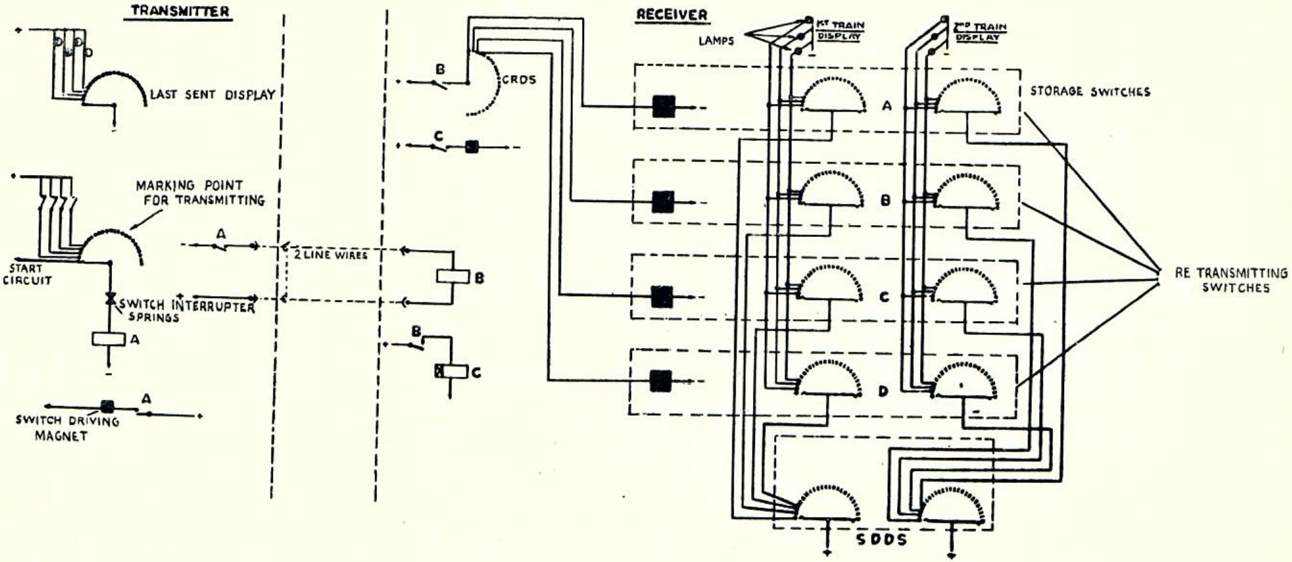


FIG. 23 —**Circuit Elements of Typical Train Describer. (Employing Open Line Impulsing).**

reached, which in this example, for simplicity, is determined by the absence of a positive feed.

At the receiver provision is made for storing four descriptions and displaying the first two. One switch is provided for each storage, two banks of each being indicated to illustrate the method of obtaining first and second train display.

The C.R.D. switch directs each code of impulses to the driving magnets of the storage switches in turn, i.e. firstly to storage "A," then "B," and so on in cyclic order.

The S.D.D. switch controls the sequence in which the stored descriptions are displayed. Two banks of the switch are indicated, one for effecting first train display and the other for the second display, sequencing being obtained by this switch taking one step forward. Contacts of the bank controlling the first train display are connected to storage switches in the order "A-B-C-D," and the bank contacts controlling the second display in the order "B-C-D-A."

When the first train passes out of section, the storage switch showing its particular description is self-driven to normal, and the S.D.D. switch is then advanced one step. In the illustration, "B" storage would then be displayed as first train and "C" storage as second.

Retransmitting is readily effected by using a level of the storage switches for transmitter marking.

Electrical Supply

The control equipment usually operates from a 50 v. d.c. supply obtained from a secondary battery fed from an automatic charging rectifier to keep the voltage output of the battery to within ± 3 of the nominal 50 volts. It is necessary to avoid an excessive voltage drop in feeder cables from the battery.

Maintenance

Maintenance may be divided into two categories :—

(i) Service faults.

(ii) Periodic inspection, adjustment and overhaul.

Faults in service must be rectified by regular maintenance staff on site who should be properly instructed and provided with circuit diagrams, adjustment charts and the appropriate tools.

To keep the equipment in good condition over its full life, detailed inspection, adjustment, etc., should be undertaken at periodic intervals. A convenient practice sometimes adopted is to secure the service of specialised staff from the manufacturer to make an overhaul every 3 or 5 years. This ensures that relays and switches are adjusted quickly and efficiently to fit the equipment for another spell of service.

In considering service faults it will be appreciated that since this class of equipment has a multiplicity of connections a fault may occur very occasionally due to a broken wire, dirty contact or the like. The key to good performance is to find and rectify a fault whenever it occurs or as soon as possible afterwards, and not to reset and hope that it will clear itself. A definite fault in the common part of a circuit must be cleared before the equipment can be set into operation again, but if it is in a selective part of the circuit, it might be left uncleared, e.g. a broken wire for one particular description in one particular storage will only show up very occasionally. It has been found in service that an installation may have several such faults uncleared, resulting in an indifferent overall performance of the system.

Planning a Well-Balanced Scheme

It is well known that the application of automatic telephone equipment and technique makes it possible to design train describer systems which will fulfil the most complicated traffic requirements. When planning a scheme, however, it is in the interests of all concerned to see that the features required of the equipment shall be related to the complexities involved and full regard should be given to ultimate maintenance in service.

An important decision to be made is whether instruments shall have manual transmission and clearing or whether part or full automatic operation from track circuits, etc., shall be employed. It is a choice between having simple equipment which requires a signalman to make certain push-button operations, or a more complex equipment to fulfil automatically the retransmitting and transfer operations.

If it is decided to employ automatic working it is desirable to arrange the system, whenever possible, to conform with the characteristics of developed equipment, and in this respect experience has shown that reference to the manufacturer in the planning stage of a scheme will make for all-round economy and simplicity.

Conclusion

The modern storage type train describer has become an essential part of new power signalling installations where traffic intensity is appreciable. Bell codes, or the telephone, could be used, but undue strain would then be imposed upon the signalman's memory which might bring about costly errors. By introducing a comprehensive system of train describers the number of signalmen required to work a large box may well be reduced.

The general scope of application may be summarised as follows :—

(*a*) *Automatic Block Sections.* At junction and terminal boxes where automatic block sections are introduced to permit the running of several trains between boxes.

(*b*) *Interlocking Areas.* At large junction or terminal stations where more than one train may be in section from the next box, and where trains may be switched from one track to another. Other facilities which can be provided are :—

  (i) Early advice of approaching trains from a box some distance out.

  (ii) Repeater instruments remote from the main box for use of station staff, etc.

  (iii) Special instruments for the working of light engines from sheds.

  (iv) Special shunters' instruments to ask for the operation of points remote from the main cabin.

(*c*) *Platform Indicators.* Provision can be made for operating platform indicators for the use of the travelling public. These intruments may be part of the main describer system or a special system for the purpose.